AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-10 (cancelled).

11. (Previously Presented) A method for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the method comprising:

sampling a preamble comprising a known string of data bits;

estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

calculating a cost function ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$);

varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$) to calculate a plurality of cost functions; and

selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), wherein selecting the minimum value cost function further comprises selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

12. (Original) The method of claim 11, wherein selecting the minimum value cost function further comprises selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

13. (Currently Amended) A method for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the method comprising:

sampling a preamble comprising a known string of data bits;

estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

calculating a cost function ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$);

varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$) to calculate a plurality of cost functions; and

selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$)~~The method of claim 11~~, wherein selecting the minimum value cost function further comprises selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

14. (Original) The method of claim 13, wherein selecting the minimum value cost function further comprises selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

Claims 15-24 (cancelled).

25. (Previously Presented) A communications channel for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over the communications channel, the communications channel comprising:

a sampler for sampling a preamble comprising a known string of data bits;

a first calculator for estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

a second calculator for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$); and

a selector for determining the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$),-wherein the selector determines the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

26. (Original) The communications channel of claim 25, wherein the selector determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

27. (Currently Amended) A communications channel for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over the communications channel, the communications channel comprising:

a sampler for sampling a preamble comprising a known string of data bits;

a first calculator for estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

a second calculator for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$); and

a selector for determining the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$),~~The communications channel of claim 25,~~ wherein the selector determines the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

28. (Original) The communications channel of claim 27, wherein the selector determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

Claims 29-38 (cancelled).

39. (Previously Presented) A disk drive system for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the system comprising:

rotating magnetic media for storing data;

a motor for rotating the magnetic media;

a recording head for transmitting data;

an actuator for positioning the recording head; and

a communications channel for communicating data to be stored on or read from the recording media, wherein the communications channel further comprises a sampler for sampling a preamble comprising a known string of data bits, a first calculator for estimating the sampled preamble ($\vec{Y}$), a second calculator for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a

function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$), and a selector for determining the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), and wherein the estimated preamble further comprises an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$),-wherein the selector determines the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

40. (Original) The system of claim 39, wherein the selector determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

41. (Currently Amended) <u>A disk drive system for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the system comprising:</u>

<u>rotating magnetic media for storing data;</u>
<u>a motor for rotating the magnetic media;</u>
<u>a recording head for transmitting data;</u>
<u>an actuator for positioning the recording head; and</u>

<u>a communications channel for communicating data to be stored on or read from the recording media, wherein the communications channel further comprises a sampler for sampling a preamble comprising a known string of data bits, a first calculator for estimating the sampled preamble ($\vec{Y}$), a second calculator for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$), and a selector for determining the cost function</u>

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<u>($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), and wherein the estimated preamble further comprises an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$),</u>~~The system of claim 39,~~ wherein the selector determines the cost minimum value function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

42. (Original) The system of claim 41, wherein the selector determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

Claims 43-52. (Cancelled)

53. (Previously Presented) A communications channel for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over the communications channel, the communications channel comprising:

a means for sampling a preamble comprising a known string of data bits;

a means for estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

a means for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$); and

a means for selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an

optimal estimated phase ($\hat{\Phi}$)-wherein means for selecting selects the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

54. (Original) The communications channel of claim 53, wherein the means for selecting selects the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

55. (Currently Amended) A communications channel for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over the communications channel, the communications channel comprising:

a means for sampling a preamble comprising a known string of data bits;

a means for estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

a means for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$); and

a means for selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$)~~The communications channel of claim 53~~, wherein the means for selecting selects the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

56. (Original) The communications channel of claim 55, wherein the means for selecting selects the minimum value cost function by selecting a second minimum cost function from the

plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

Claims 57-66. (Cancelled)

67. (Previously Presented) A computer program product encoded with a computer program for performing a method for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the method comprising:

sampling a preamble comprising a known string of data bits;

estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);

calculating a cost function ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$);

varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$) to calculate a plurality of cost functions; and

selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), wherein selecting the minimum value cost function further comprises selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

68. (Original) The computer program product of claim 67, wherein selecting the minimum value cost function further comprises selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

69. (Currently Amended) <u>A computer program product encoded with a computer program for performing a method for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the method comprising:</u>

<u>sampling a preamble comprising a known string of data bits;</u>

<u>estimating the sampled preamble ($\vec{Y}$), the estimated preamble further comprising an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$);</u>

<u>calculating a cost function ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$);</u>

<u>varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$) to calculate a plurality of cost functions; and</u>

<u>selecting the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$),</u>~~The computer program product of claim 67,~~ wherein selecting the minimum value cost function further comprises selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

70. (Original) The computer program product of claim 69, wherein selecting the minimum value cost function further comprises selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

Claims 71-80. (Cancelled)

81. (Previously Presented) A disk drive system for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the system comprising:

means for storing data;

means for rotating the means for storing;

means for transmitting data to and from the means for storing;

means for positioning the means for transmitting data; and

means for communicating data to be stored on or read from the means for storing, wherein said means for communicating further comprises means for sampling a preamble comprising a known string of data bits, means for estimating the sampled preamble ($\vec{Y}$), means for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$), and means for determining the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), and wherein the estimated preamble further comprises an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$),-wherein the means for selecting determines the minimum value cost function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated frequency ($\hat{f}$).

82. (Original) The system of claim 81, wherein the means for selecting determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).

83. (Currently Amended) <u>A disk drive system for an optimal one-shot phase and frequency estimation for timing acquisition for signals transmitted over a communications channel, the system comprising:</u>

<u>means for storing data;</u>

<u>means for rotating the means for storing;</u>

<u>means for transmitting data to and from the means for storing;</u>

<u>means for positioning the means for transmitting data; and</u>

means for communicating data to be stored on or read from the means for storing, wherein said means for communicating further comprises means for sampling a preamble comprising a known string of data bits, means for estimating the sampled preamble ($\vec{Y}$), means for calculating a plurality of cost functions ($C(\hat{f},\hat{\Phi})$) as a function of the estimated frequency ($\hat{f}$) and the estimated phase ($\hat{\Phi}$) by varying at least one of the estimated frequency ($\hat{f}$) or estimated phase ($\hat{\Phi}$), and means for determining the cost function ($C(\hat{f},\hat{\Phi})$) having a minimum value, wherein said cost function having the minimum value is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$), and wherein the estimated preamble further comprises an estimated amplitude ($\hat{A}$), an estimated frequency ($\hat{f}$), and an estimated phase ($\hat{\Phi}$),~~The system of claim 81,~~ wherein the means for selecting determines the cost minimum value function by selecting a plurality of first minimum cost functions such that each of the first minimum cost functions has a different estimated phase ($\hat{\Phi}$).

84. (Original) The system of claim 83, wherein the means for selecting determines the minimum value cost function by selecting a second minimum cost function from the plurality of first minimum cost functions, and wherein the second minimum cost function is a function of an optimal estimated frequency ($\hat{f}$) and an optimal estimated phase ($\hat{\Phi}$).